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ABSTRACT

This study used five cueing systems composed of 16 cues each in combination with three topical areas to form cue-topic pairs which acted as stimulus items for the retrieval of naturally stored information. The five cue systems were composed of: randomly selected words, randomly selected nouns, the Wilson and Arnold system, a modification of the Kant system of "categories of understanding," and the subject's own self-generating cues. On the basis of a frequency ranking, subjects from the same population as the experimental sample ranked three topics from a list of 20. A repeated measures design was used where subjects in each one of the cue system's groups were in a random order presented the same 16 cues three times, each time with a different one of the three topics forming 48-cue topic pairs overall. The results indicated that the subject's own self-generated cue system significantly facilitated a retrieval of naturally stored information as compared to the other four cue systems. There were no significant differences in the cue systems: random word, random noun, Wilson and Arnold, and Kant with respect to the facilitation of items or information retrieved. (Author/WR)

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ITEMS OF INFORMATION RETRIEVED AS A FUNCTION OF CUE SYSTEM AND TOPICAL AREA

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ABSTRACT

ITEMS OF INFORMATION RETRIEVED AS
A FUNCTION OF CUE SYSTEM AND TOPICAL AREA

Five cueing systems composed of sixteen cues each were used in combination with three topical areas to form cue-topic pairs which acted as stimulus items for the retrieval of naturally stored information. The following composed the five cue systems: (1) randomly selected words; (2) randomly selected nouns; (3) the Wilson and Arnold system; (4) a modification of the Kant system of "categories of understanding"; (5) the subject's own self-generating cues. On the basis of a frequency ranking, subjects from the same population as the experimental sample ranked three topics from a list of 20. The highest ranked topics were:: (1) abortion; (2) wage and price control; and (3) political election reform. A repeated measures design was used where subjects in each one of the cue system's groups were in a random order presented the same 16 cues three times, each time with a different one of the three topics forming 48 cue-topic pairs overall. The results indicate that the subject's own self-generated cue system significantly facilitated a retrieval of naturally stored information as compared to the other four cue systems. There were no significant differences in the cue systems: random word, random noun, Wilson and Arnold, and Kant with respect to the facilitation of items of information retrieved. With exception of the topic, abortion, in the Kant system there were no significant differences for the independent variable of topic.

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ITEMS OF INFORMATION RETRIEVED AS A FUNCTION OF CUE SYSTEM AND TOPICAL AREA

In response to the question of what should be the primary research effort on the part of the communication scholar, Gerald Miller suggested at the 1968 New Orleans Conference that the focus of attention should be directed:

> . . . at questions involving interactional relationships between Information I and InformationII. Most scientifically useful generalizations concerning human information processing will have to take account of both the environmental stimuli available to the individual (Information I) and the background of experiences that he brings with him to the situation (Information II).[1]

Implicit in these comments is the suggestion that in order to deal with this particular issue, the means for determining the available fund of Information II must be developed and generalisations concerning ways in which differences in Information II affect the processing of Information I must also be sought.[2] It is with respect to the utilization of external stimuli (Information I) as a strategy in retrieving items of previously stored information (Information II) that the concerns of this research effect are directed. A logical extension of this type of research is to its applicability in describing psychological processes and in human problem solving.

In a sense the conceptual way in which Miller develops his concept of Information II stems from the historical scientific inquiry of the theory of categories and categorising behaviors. Axiomatic to most

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theories of verbal behavior is a notion of man's propensity toward a categorizing behavior which filters, differentiates and organizes knowledge. The necessity of such categorizing behavior has been pointed out by Bruner, Goodnow and Austin who suggest that such categorizing behavior: (1) reduces the complexity of man's environment; (2) enables him to identify objects in his surrounding world; (3) tends to reduce the necessity for constant learning; (4) tends to provide direction for instrumental activity; (5) facilitates his ability to order and relate classes of events; and (6) facilitates his capacity to anticipate the consequences of future action.[3]

Another theoretical approach to how man organizes his environment was postulated by George Kelly in his personal construct theory. Kelly's individuality corollary directly suggests that persons differ from each other in their construction of events.[4] While theorists such as Bruner, Goodnow and Austin and Kelly have concerned themselves with how man categorizes and organizes his information, other researchers have investigated how man gains access to the information he has previously organized and categorized.

The use of external stimuli as a strategy in directing our categorizing behavior to improve man's intrinsic ability to process and recall information may be referred to as a cueing system. Such cueing systems have been described by Gross as ". . . one or more sets of categories or two or more variables that stand in ordinal, classificatory or functional relationship to each other."[5] A number of theorists including George Mandler have theorized that the human organism organizes his information into superordinate structures with a hierarchy of subcategories or chunks

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of information. Such behavior has been viewed as a three-stage process initiating with the perception of stimuli input and its place in relation to other stimuli, to the chunking of that stimuli within lower levels in the hierarchy to the establishing of links or relationships at other levels.[6] Mandler's theory may be viewed as the psychological processes involving Information I and Information II and their interaction.

While theoretical excursions into the nature of human information processing have been broad in scope, empirical investigation has tended to focus on: (1) the effects of categorizing behavior on information recall; (2) the use of verbal stimuli in recall; and (3) the effects of varying grammatical form and syntax of verbal stimuli on information recall.

The emphasis, however, of research in this area has been upon the use of cue systems in facilitating human recall of "artificially" stored information. For the purposes of this study, "artificially" stored information has been defined as information learned as a part of the experimental treatment. Little investigation has been concerned with the use of cue systems in facilitating retrieval of "naturally" stored information, that is, primarily information learned by the subject independent of experimental treatment.

Recently there has been an interest on the part of the communication scholar in facilitating the retrieval of naturally stored information. In an article based upon his Ph.D. dissertation, Nelson found that subjects using the Wilson and Arnold Cue System based on the Aristotelian topical system retrieved more items of information to high meaningful issues and low meaningful issues than did subjects not using a cue system (i.e. free recall).[7] Subsequently, Nelson and Petelle, using a similar

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research design found that subjects using the Wilson and Arnold Cue System retrieved more items of information to a social issue problem than did free recall subjects. Also, when these items were arranged so as to form a workable solution subjects using a cue system developed solutions considered to be superior to solutions developed by free recall groups when these solutions were rank ordered by both free recall and cue recall groups.[8]

Although Nelson only utilized a single cueing system, he raised the questions of the effectiveness of other possible cueing systems and the generalized applicability of cueing systems for information retrieval for different topical areas. In relation to the first question, Infante varied the cueing system, the task and the form of recall and found that subjects still discover more information and arguments when cued by Topoi.[9]

In response to the second question, Buchholz and Petelle compared the Wilson and Arnold cue system, their modification of the Kant system, a random word system and free recall. Significant differences were found between the Wilson and Arnold system and free recall and between the Kant and free recall. No significant differences were found between the random word system and free recall and between the Kant and the Wilson and Arnold systems.[10]

The usefulness of the Wilson and Arnold cue system to different categories of issues as well as the relative ability of individual cues within the system was investigated by Petelle. Using the topical areas of big business, wage and price control and unemployment, significant differences in number of items of information retrieved were only found between unemployment and big business and unemployment and wage and price

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control. Furthermore, results indicated certain cues accounted for a significantly greater proportion of the items retrieved than did other cues.[11]

Support for the findings of the differential utility of certain cues is found in the results of Thompson and Tulving. They concluded that retrieval cues facilitate recall when they are presented during both learning and recall. Retrieval cues do not facilitate recall when they are presented only for the recall trial unless the pre-established association between the cue and the to be recalled word is of considerable strength. They further note that a retrieval cue is effective only if the information about its relation to the recalled item is stored at the same time that the item is stored. In general, they maintain that the presence of a retrieval cue having a strong pre-experimental association with the to be recalled item has little influence on the recall of the item if the item has been studied in the presence of a weak associative. They have labeled the explanation of their findings the "Encoding Specificity Hypothesis."[12]

In a related study but taking a significantly different approach, Schaub and Lindley presented subjects with 36 high and low meaningful trigrams. Subjects generated their own associations (i.e. cues) to the trigrams. Subsequently, subjects who were presented their own associations (cues) prior to the presentation of the trigrams recalled significantly more trigrams of both high and low meaningfulness than did subjects who did not employ their own self-generated associations. The frequent repetition of self-generated associations allowed subjects to recall more low meaningful trigrams.[13]

Research using cue systems involving varying word order as well as grammatical form has been conducted by Lambert and Paivio. They

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concluded that noun-adjective order was superior to adjective-noun order in the recall of information.[14] In a related study, DiVesta and Ross found that "the results supported the hypothesis that noun imagery is a more critical determinant of paired-associative learning that adjective imagery, and that this effect is more pronounced in the stimulus than in the response element."[15] Further research in this area, such as that of R. S. Lockhart, Paivio and Foth, and Yuille, Paivio and Lambert have produced similar results.[16]

The review of the previously cited research reveals the following comparative utility of cue systems for information retrieval: (1) the Wilson and Arnold and Kant cue systems were found to be superior in number of items of information retrieved as compared to the random word and free recalled cue systems; (2) the use of noun forms as a cue system appears to be superior to cue systems of another grammatical form; (3) there appears to be no significant difference between random word cue systems and free recall systems; (4) self-generated association cues appear to be superior to the absence of associative cues and superior to repeated presentations; (5) there appears to be a differential utility for some cue systems over other cue systems for different topical areas.

Previous research findings indicate support for the viability of a priori cue systems in the retrieval of artificially stored information and naturally stored information. Based upon the previous theoretical and empirical research which has primarily been concerned with the retrieval of artificially stored information and the rather limited knowledge concerning the retrieval of naturally stored information, the following hypotheses were formulated: (a) there will be no significant

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differences in the number of items of naturally stored information retrieved among the five cue systems of random word, random noun, Wilson and Arnold, Kant, and self-generated; (b) there will be no significant differences in the number of items of naturally stored information retrieved according to the topical areas of abortion, wage and price control, and political election reform.

PROCEDURES

Two independent variables were manipulated: cue system and topical area. Cue system had five levels: random word, random noun, Wilson and Arnold, Kant, and self-generated. Topical area had three levels: abortion, wage and price control and political election reform. The dependent variable was the number of naturally stored items of information retrieved.

The independent variable cue system was operationalized in the following manner. The random word system of 16 words was created by randomly selecting words from Roget's Thesaurus. The random noun cue system of 16 nouns was obtained in the same manner as the random word with the exception that the first noun encountered on a randomly selected page was chosen. The Wilson and Arnold cue system of 16 words was obtained from the text, Public Speaking: As A Liberal Art, by the respective authors.[17] The Kant system of 16 words was obtained from a modification of the Kantian "Categories of Understanding" previously tested by Buchholz in an unpublished paper.

(Insert Table 1)

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The self-generated cue system of 16 words was developed in the following manner: Three weeks prior to the experimental treatment, subjects assigned to the self-generation group were asked to list "16 words which would help you solve any problem." Subjects were given five minutes in which to list the 16 words. Subjects were told to stop when they had listed 16 words even if the five-minute time period was not over. The self-generation group thus developed 16 of their own idiosyncratic cues.

The independent variable of topical area consisting of three topical areas was determined in the following way: 100 randomly selected subjects from the same population used in the experimental sample were asked to rank order, from a list of 20 preselected areas, those areas they felt were most important. Based on highest frequency rankings, the topics of abortion, wage and price control and political election reform were identified. Subjects who ranked topics were excluded from the experimental sample.

The dependent variable was operationalized as the number of items of information generated by the subject and consisted primarily of words and word phrases (a phrase was scored as one item of information).

One hundred sixty subjects were randomly assigned to the five cue system groups. Due to the random assignment procedure, groups of unequal size resulted. The three topical areas were randomly ordered for each subject with three sets of the 16 cues placed in an individual subject package, one cue-topic pair to a page. Upon entering the experimental room subjects were randomly assigned the treatment package.

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Subjects (with the exception of the self-generation group who received their own cues) were randomly assigned the treatment package containing the instructions on the first page and the 48 cue-topic pairs on the following pages. The experimenter read the instructions which essentially asked the subject to generate a list of as many items of information as he could think of after viewing the cue-topic pair. The subjects were then given one minute to generate items of information for each cue-topic pair. No talking was allowed between subjects and subjects were separated by at least one seat.

Hypotheses were tested by means of a 5 x 3 analysis of variance for unequal group sizes, with repeated measures on one factor (topical area). Scheffe's post hoc comparison of means test was used to analyze the specific nature of significant effects developed by the analysis of variance. Due to the unfamiliarity of the dependent variable the F_{max} procedure was used to assess the homogeneity of the variance to the five cue system groups.[18]

RESULTS

Cue System Hypothesis.

Analysis of the cue system hypothesis was based on a 5 x 3 ANOVA for repeated measures and unequal group size.[19] Repeated measures were on the topical area since each subject received the three topics, in a random order using three sets of the same 16 cues. Analysis yielded a significant effect due to cue system group ($F = 3.42$, $df = 4/135$, $p < .05$)

(Insert Table 2)

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The F_{max} for cue system groups yielded no significant differences in the variance between the groups (F_{max} = 1.82, df = 5/70, $p < .05$). No interaction effect was found between cue system group and topical area ($F < 1$). The Scheffe test yielded significant differences between the self-generating group and all other cue system groups. All other between cue system comparisons were not significant.

(Insert Table 3)

The results indicate that the self-generating group, across three topical areas, facilitates more items of information retrieved than other cue systems tested.

(Insert Table 4)

Thus the hypothesis of no significant differences between cue systems failed to receive support.

Topical Area Hypothesis.

Using the tests mentioned above, the analysis of variance due to topical area was significant ($F = 3.64$, df = 2/310, $p < .05$). (See Table 2) The Scheffe test yielded a significant difference between the topic abortion and the other two topical areas for all cue systems combined.

(Insert Table 5)

No other comparisons were significant for topical area for all cue systems combined. The results indicate that a significantly higher number of items of information was retrieved on the topic abortion than on the other topical areas. (See Table 4) Thus the hypothesis of no significant differences between the topical areas failed to receive support.

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In order to more specifically assess the sources of the differential effect of the topic of abortion, a Scheffé test on topical area within individual cue systems was run and yielded a significant difference only for the Kant system on the topic of abortion ($F = 2.83$, $df = 2/60$, $p < .05$).

DISCUSSION

The importance of distinguishing between artificially and naturally stored information centers on the experimental paradigm in which the information was stored. If the use of cue systems as facilitators for the retrieval of information are to be extended to human communicative behavior in general, they must be appropriate for the retrieving of information beyond that which is a part of the experimental treatment.

Previous research has indicated the superiority of a priori cue systems over free recall in facilitating the retrieval of items of information. This study compared the effectiveness of four a priori cue systems and a self-generated cue system. The results revealed no significant differences in the number of items of information retrieved among the four a priori cue systems. Significant differences did occur, however, when each of the four a priori systems were compared with the self-generated system.

For four of the five cue systems (random word, random noun, Wilson and Arnold and self-generating) there were no significant differences in the number of items of information retrieved for the three topical areas of abortion, wage and price control and political election reform. That significant differences were found for only the

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Kant system for the one topic of abortion suggests that the topic may have greater associations with some or all of the Kant system's cues. The isolated finding of topic effect on the Kant cue system is possibly supported by an earlier finding of Petelle that certain cues accounted for a greater proportion of the items retrieved compared to other cues within the same system. This suggests that for some topics specific cues may be more viable than others in facilitating recall. The limited extent, however, of the effects of topical area on cue systems found in this study in no way supports any generalizations concerning the facilitation effects of particular cues within cue systems for specific topical areas. The fact that the topic abortion facilitated retrieval for only one cue system suggests the need for more specific determination of individual cue effects on information retrieval in future research.

While this study dealt with naturally as opposed to artificially stored information the results can be partially interpreted by previous findings on artificially stored information.

Thompson and Tulving,[20] for example, concluded that the associative value of retrieval cues for artificially stored information was an important factor in the retrieval of that information. They also determined that the effectiveness of an a priori retrieval cue was directly related to its association with the artificially stored information. While the use of such a cue may be directly related to the subject's association with artifically stored information, it is quite possible as indicated by the results of this study that when a subject retrieves naturally stored information his own best stimulus is his own self-generated cue.

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Tulving and Pearlstone[21] have suggested that subjects not only tend to group (categorize) artificially stored information according to (1) meaningful conceptual categories; (2) associative groupings; (3) structural characteristics; and (4) similarity of sound patterns, but also tend to store information in a unique and idiosyncratic order. Kelly's individuality corollary lends further credence to these findings. If, indeed, individuals do have unique ways in which they categorize and organize their information, this may, to a large extent, explain why subjects generating their own cues (idiosyncraticness) were able to retrieve more items of naturally stored information than were subjects who were provided with an a priori cue system.

Further credence to the utility of self-generated cue systems is given by Basden and Higgins who found that recall of items of information was directly associated with inter-item associative strength when categories were determined by the subject's own choice.[22]

As a final statement, it is worth noting that the use of self-generated cue systems is a significant contemporary extension of the ancient concept of invention and its role in improving human information processing. The need for further research in this area was suggested by Karl Wallace in the June, 1972 issue of Spectra when he expressed the importance of the renewed interest on the part of the rhetoricism in the ancient concept of invention and the significance of the ". . . new concern for invention, i.e. for systems of topics that aid in recalling experience during moments of utterance and that direct search and inquiry into what is needed and not ready at hand."[23]

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The results of this study suggests that further research into the use of self-generated cue systems is a viable concern for the speech communication scholar and may very well provide additional insight into the nature of human information processing.

More specifically, future research in this area needs to focus on the application of self-generating cue systems as applied to individual and group problem solving and creative idea development.

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Table 1

CUES FOR SYSTEMS: RANDOM WORD, RANDOM NOUN, WILSON AND ARNOLD AND KANT

Random Word	Random Noun
husbandman	fluke
axe	boat
celebration	colorlessness
do	creator
create	twilight
made short work of	elasticity
doctrine	feature
evident	handle
ornamental stroke	magnification
handle	keel
be dishonest	measure
clever	total
liberate	acknowledgment
miser	prodigy
total	rejoinder
participation	sap

Wilson and Arnold	Kant
existence	quantity
degree	unity
spatial	plurality
time	totality
motion	quality
form	affirmation of reality
substance	negation
capacity to change	limitation
potency	relationship
desirability	substance
feasibility	cause-effect
causality	community
correlation	modality
genus-species	possibility
possibility-impossibility	existence
similarity-dissimilarity	necessity-result

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Table 2

ANALYSIS OF VARIANCE (UNWEIGHTED MEANS SOLUTION)

FOR CUE SYSTEM DIFFERENCES

N = 160

Source	df	ms	F
Cue System (A)	4	8,456.02	3.42*
Topical Area (B)	2	693.06	3.64*
AB	8	4.42	1
Subjects within groups	155	2,471.19	
BX Subjects within groups	310	190.52	

*$p < .05$. Total source of variance is not given as in the unweighted means solution within subject's error plus between subject's error total.

Table 3

MULTIPLE COMPARISONS (SCHEFFE) OF THE MEAN ITEMS OF INFORMATION RETRIEVED FOR CUE SYSTEM GROUP

Comparison	Random Word (RW) $\underline{n} = 33$ $\bar{x} = 247.18$	Random Noun (RN) $\underline{n} = 31$ $\bar{x} = 239.79$	Wilson & Arnold (WA) $\underline{n} = 30$ $\bar{x} = 239.27$	Kant (KA) $\underline{n} = 30$ $\bar{x} = 238.25$	Self-Generation (SG) $\underline{n} = 36$ $\bar{x} = 303.73$
	$\bar{x}$ difference		↑/↓↑		
RW vs. RN	7.39		0.58		
RW vs. WA	7.91		0.62		
RW vs. KA	8.93		0.70		
RW vs. SG	56.55		4.41*		
RN vs. WA	.52		0.04		
RN vs. KA	1.54		0.01		
RN vs. SG	63.94		4.69*		
WA vs. KA	1.02		0.74		
WA vs. SG	64.46		5.03*		
KA vs. SG	65.48		5.12*		

*$p < .05$. The critical ↑/↓↑ ratio necessary for significance was ± 3.109.

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Table 4

MEAN NUMBER OF ITEMS OF INFORMATION GENERATED AS A FUNCTION OF CUE-TOPIC TEST FOR EACH OF THE CUE SYSTEM GROUPS AND EACH OF THE TOPICAL AREAS

Cue System	Topical Area Abortion	Wage and Price Control	Political Election Reform	Total
Random Word	83.0	80.76	83.42	247.18
Random Noun	80.65	78.62	80.52	239.79
Wilson and Arnold	81.30	79.87	78.10	239.27
Kant	84.74	75.17	78.34	238.25
Introspective	105.03	101.25	97.45	303.73
Total	434.72	415.67	417.83	1268.22

Table 5

MULTIPLE COMPARISONS (SCHEFFE) AMONG THE MEAN ITEMS OF INFORMATION RETRIEVED FOR TOPICAL AREA

Comparison	ABORTION (AB) $n = 160$ $\bar{x} = 434.72$	WAGE & PRICE CONTROL (WP) $n = 160$ $\bar{x} = 415.67$	POLITICAL ELECTION REFORM (PR) $n = 160$ $\bar{x} = 417.83$
	$\bar{x}$ difference		$t/\hat{t}$
AB vs. WP	19.05		12.29*
AB vs. PR	16.89		10.89*
WP vs. PR	2.16		1.39

*$p < .05$. The critical $t/\hat{t}$ ratio necessary for significance was $\pm$ 2.45.

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FOOTNOTES

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